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ABSTRACT

Statistics anxiety, which is experienced by as many as 80% of graduate students, has been found to weaken performance in statistics and research methodology courses. This study examined the prevalence of procrastination on statistics assignments among graduate students and the relationship between academic procrastination and six dimensions of statistics anxiety. Participants were 135 graduate students enrolled in 3 sections of a required introductory-level educational research course at a southeastern university. Findings reveal that a high percentage of students reported problems with procrastination on writing term papers, studying for examinations, and completing weekly reading assignments. Overall academic procrastination was significantly positively related to the following dimensions of statistics anxiety: interpretation anxiety, tests class anxiety and fear of asking for help. A canonical correlation analysis reveals that academic procrastination resulting from both fear of failure and task aversiveness was related significantly to the worth given to statistics, interpretation anxiety, test and class anxiety, computational self-concept, fear of asking for help, and fear of the statistics instructor. Implications for statistics anxiety reduction as a procrastination intervention are discussed. (Contains 4 tables and 76 references.) (Author/SLD)

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I'll Begin My Statistics Assignment Tomorrow:

The Relationship Between Statistics Anxiety and Academic Procrastination

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Abstract

Statistics anxiety, which is experienced by as many as 80% of graduate students, has been found to debilitate performance in statistics and research methodology courses. As such, it is likely that statistics anxiety is, in part, responsible for many students delaying enrollment in these courses for as long as possible. Moreover, it is possible that, once enrolled in these courses, students with high levels of statistics anxiety tend to procrastinate on assignments. Thus, the purpose of this study was (1) to examine the prevalence of procrastination among graduate students, and (2) to investigate the relationship between academic procrastination and six dimensions of statistics anxiety.

Participants were 135 graduate students enrolled in three sections of a required introductory-level educational research course at a southeastern university. Findings revealed that a high percentage of students reported problems with procrastination on writing term papers, studying for examinations, and completing weekly reading assignments. Overall academic procrastination was significantly positively related to the following dimensions of statistics anxiety: interpretation anxiety, test and class anxiety, and fear of asking for help. A canonical correlation analysis ($R_{c1} = .51$) revealed that academic procrastination resulting from both fear of failure and task aversiveness was related significantly to worth of statistics, interpretation anxiety, test and class anxiety, computational self-concept, fear of asking for help, and fear of the statistics instructor. Implications for statistics anxiety reduction as a procrastination intervention are discussed.

I'll Begin My Statistics Assignment Tomorrow:

The Relationship Between Statistics Anxiety and Academic Procrastination

It has been estimated that as many as 80% of graduate students experience uncomfortable levels of statistics anxiety (Onwuegbuzie, 1999a). According to Onwuegbuzie, DaRos, and Ryan (1997), statistics anxiety is the apprehension which occurs when individuals encounter statistics in any form and at any level. Moreover, statistics anxiety is situation-specific, inasmuch as the symptoms only emerge at a particular time and in a particular situation--specifically, when learning or applying statistics in a formal setting (Onwuegbuzie et al., 1997; Zeidner, 1991). Many students tend to experience high levels of statistics anxiety when confronted with statistical ideas, problems, or issues, instructional situations, or evaluative situations (Feinberg & Halperin, 1978; Onwuegbuzie & Daley, 1996; Onwuegbuzie & Seaman, 1995; Zeidner, 1991). Indeed, statistics anxiety appears to involve a complex array of emotional reactions which, in mild forms, may induce only a minor discomfort. Severe forms, however, can result in negative outcomes, such as apprehension, fear, nervousness, panic, and worry (Onwuegbuzie et al., 1997).

Previous research indicates that statistics anxiety is a multidimensional construct (Cruise, Cash, & Bolton, 1985; Cruise & Wilkins, 1980; Onwuegbuzie et al., 1997). In particular, using factor analysis, Cruise et al. (1985) identified six components of statistics anxiety, namely: (1) Worth of Statistics, (2) Interpretation Anxiety, (3) Test and Class Anxiety, (4) Computational Self-Concept, (5) Fear of Asking for Help, and (6) Fear of Statistics Teachers. According to these authors, *worth of statistics* refers to a student's perception of the relevance of statistics. *Interpretation anxiety* is concerned with the

anxiety experienced when a student is faced with making a decision from or interpreting statistical data. *Test and class anxiety* refers to the anxiety involved when taking a statistics class or test. *Computational self-concept* involves the anxiety experienced when attempting to solve mathematical problems, as well as the student's perception of her/his ability to do mathematics. *Fear of asking for help* measures the anxiety experienced when asking a fellow student or professor for help in understanding the material covered in class or any type of statistical data, such as that contained in an article or a printout. *Fear of statistics teachers* is concerned with the student's perception of the statistics instructor.

Statistics anxiety either as a unidimensional or as a multidimensional construct has been found to be related to mathematics self-concept, number of college mathematics courses completed, academic major, academic status, perception of previous success in mathematics courses, the time elapsed since students' last mathematics course, mathematics ability, mathematics preparation, calculator use, learning style, ethnicity, and expected grade (Benson, 1989; Onwuegbuzie, 1997; Onwuegbuzie, 1999b; Robert & Saxe, 1982; Tomazic & Katz, 1988; Wilson, 1997; Zeidner, 1991).

A growing body of research has documented a consistent negative relationship between statistics anxiety and course performance (Elmore, Lewis, & Bay, 1993; Lalonde & Gardner, 1993; Onwuegbuzie & Seaman, 1995; Zeidner, 1991). In fact, statistics anxiety has been found to be the best predictor of achievement in research methodology (Onwuegbuzie, Slate, Paterson, Watson, & Schwartz, 1998) and statistics (Fitzgerald, Jurs, & Hudson, 1996; Onwuegbuzie, 1999) courses. Moreover, a causal link between statistics anxiety and course

achievement has been established. In particular, Onwuegbuzie and Seaman (1995) found that graduate students with high levels of statistics test anxiety who were randomly assigned to a statistics examination which was administered under timed conditions tended to have lower levels of performance than did their low-anxious counterparts who were administered the same test under untimed conditions. Additionally, using qualitative techniques, Onwuegbuzie (1997a) reported that statistics anxiety primarily affects a student's ability to understand fully research articles, as well as to analyze and to interpret statistical data.

Unfortunately, most of the correlates of statistics anxiety which have been identified either are immutable (e.g., ethnicity; Onwuegbuzie, 1999b) or involve predispositions which cannot be altered within a particular statistics course (e.g., mathematics preparation; Wilson, 1997). Consequently, although knowledge of these factors has helped to increase our understanding of the nature and etiology of statistics anxiety, they offer limited implications for intervention. Nevertheless, it is clear that the levels of statistics anxiety experienced by students can be so great that undertaking research methodology and statistics classes has come to be regarded by many as a negative experience (Onwuegbuzie, 1997a). In fact, as a result of anxiety, graduate students often delay enrolling in research methodology and statistics courses for as long as possible, sometimes waiting until the final semester of their degree programs--which is clearly not the optimal time to undertake such courses (Onwuegbuzie, 1997a, 1997b). Thus, although not yet empirically tested, it is likely that the propensity for academic procrastination is related to levels of statistics anxiety.

Academic procrastination, which is experienced by approximately 95% of college students (Ellis & Knaus, 1977), is defined as the purposive and needless

delay in beginning or completing tasks (Rothblum, Solomon, & Murakami, 1986). Solomon and Rothblum (1984) noted that nearly one-quarter of Caucasian-American college students report problems with procrastination on academic tasks such as writing term papers, studying for examinations, and keeping up with weekly readings. Furthermore, Clark and Hill (1994) found that between 30 and 45% of African-American undergraduate students in their sample reported problems with procrastination on writing a term paper, studying for examinations, and keeping up with weekly reading assignments. Additionally, between 55 and 60% of the students wanted to decrease their procrastination on these tasks. Academic procrastination has been found to be associated with negative academic outcomes, including missing deadlines for submitting assignments, delaying the taking of self-paced quizzes, low course grades, and course withdrawal (Beswick, Rothblum, & Mann, 1988; Rothblum et al., 1986; Semb, Glick, & Spencer, 1979).

Using factor analysis, Solomon and Rothblum (1984) found that fear of failure and task aversiveness are the primary reasons for procrastinating, with the former explaining 49% of the variance in why students procrastinate, and the latter accounting for 18% of the variance. The fear of failure factor includes items which relate to evaluation anxiety and overly perfectionistic standards for one's performance, and low self-confidence. In contrast, the task aversiveness factor comprises items which reflect a dislike of engaging in academic activities and a lack of energy. These authors reported that the percentage of college students who endorsed items representing the fear of failure factor ranged from 6.3% to 14.1%, whereas the endorsement of the task aversiveness factor ranged from 19.4% to 47.0%. These findings led them to conclude that there are two groups of procrastinators at the undergraduate level: (1) a relatively small but

extremely homogenous group of students who report procrastinating as a result of fear of failure; and (2) a relatively heterogeneous group of students who report procrastinating as a result of aversiveness of the task.

Surprisingly, however, no research appears to have examined the prevalence of academic procrastination among graduate students. This was the first purpose of the present study. The second purpose of the current research was to investigate the relationship between academic procrastination and statistics anxiety.

According to Rothblum et al. (1986), academic procrastination includes the self-reported tendency to nearly always or always experience problematic levels of anxiety associated with this procrastination. Moreover, since academic procrastination has been related positively to generalized and specific kinds of anxiety such as test anxiety and social anxiety (Rothblum et al., 1986; Solomon & Rothblum, 1984), it was hypothesized that academic procrastination would be positively related to statistics anxiety associated with worth of statistics, interpretation anxiety, test and class anxiety, computational self-concept, fear of asking for help, and fear of the statistics instructor.

Ferrari, Parker, and Ware (1992, p. 496) asserted that "understanding the conceptual 'make-up' of procrastinators from nonprocrastinators on personality measures is needed." Thus, it was hoped that findings from this study not only would increase our understanding of procrastination, but also would further our understanding of statistics anxiety--which, in turn, could assist in designing instructional and counseling strategies to improve students' related deficiencies in these areas.

Method

Subjects

Subjects were 135 graduate students from a number of education disciplines (e.g., early childhood education, elementary education, middles grades, secondary education, speech language pathology, and psychology) enrolled in several sections of a graduate-level research methodology course at a small public southeastern university. Participation in the study was voluntary and anonymous, with no subject declining. In order to participate, students were required to give their consent by signing informed consent documents. Subjects received extra course credit. The ages of the participants ranged from 21 to 51 (mean = 26.0, $SD = 6.8$). Mean academic achievement, as measured by grade point average, was 3.57 ($SD = 0.36$). The overwhelming majority of subjects was female (92.6%) and Caucasian-American (93.3%). However, a (non-parametric) Wilcoxon two-sample t-test (Hollander & Wolfe, 1973) revealed no gender difference ($p < .05$) with respect to levels of overall academic procrastination, fear of failure, and task aversiveness. Indeed, this finding is consistent with other studies in which procrastination scores by males and females were not significantly different (e.g., Effert & Ferrari, 1989a; Ferrari, 1989a, 1991a, 1991b). Additionally, a series of Wilcoxon two-sample t-tests revealed no gender difference ($p < .05$) with respect to the six dimensions of statistics anxiety. Nor was a gender difference found with respect to grade point average. Thus, all data were collapsed across gender.

Instruments and Procedure

Participants were administered the Statistical Anxiety Rating Scale (STARS) and the Procrastination Assessment Scale-Students (PASS). The STARS, which was

developed by Cruise and Wilkins (1980), is a 51-item, 5-point Likert-format instrument assessing statistics anxiety in a wide variety of academic situations. The STARS has six subscales, namely, worth of statistics, interpretation anxiety, test and class anxiety, computational self-concept, fear of asking for help, and fear of the statistics instructor. A high score on any subscale represents high anxiety in this area. Cruise et al. (1985) reported evidence of construct validity based on a factor analysis using 1,150 subjects in which six specific factors were identified after a varimax rotation. Loadings for these factors ranged from .48 to .86. Reliability of these factors, as measured by coefficient alpha, ranged from .68 to .94 (median = .88). In addition, Cruise et al. (1985), using a sample of 161 students, reported five-week test-retest reliability coefficients for each factor, ranging from .67 to .83 (median = .76). For the present study, the reliability of the STARS subscales, as measured by coefficient alpha, was as follows: worth of statistics (.96), interpretation anxiety (.90), test and class anxiety (.88), computational self-concept (.86), fear of asking for help (.81), and fear of the statistics instructor (.83).

The PASS, which was developed by Solomon and Rothblum (1984), contains two parts. The first part lists six academic tasks involving writing a term paper, studying for examinations, keeping up with weekly reading assignments, performing administrative tasks, attending meetings, and performing academic tasks in general. Respondents are asked to complete three rating scales for each of the six tasks indicating the frequency with which they procrastinate on that task (1 = Never procrastinate; 5 = Always procrastinate), whether their procrastination on the task is a problem (1 = Not at all a problem; 5 = Always a problem), and whether they want to decrease their procrastination on the task (1=Do not want

to decrease; 5 = Definitely want to decrease). As recommended by its authors (Solomon & Rothblum, 1984), the PASS items pertaining to (1) the frequency with which respondents procrastinate on a task and (2) whether their procrastination on that task is a problem were summed to provide an overall measure of academic procrastination, with total scores ranging from 12 to 60. Higher scores are indicative of self-reported academic procrastination.

The second section of the PASS asks students to think of the last time they procrastinated on writing a term paper and to indicate how much each of 26 reasons reflects why they procrastinated (1 = Not at all reflects why I procrastinated; 5 = Definitely reflects why I procrastinated). A factor analysis undertaken by the authors on the reasons why college students procrastinate indicated two factors, namely, fear of failure and task aversiveness.

The PASS has been shown to possess adequate construct validity, as evidenced by significant relationships between scores on the scale and behavioral measures of procrastination such as delay in taking self-paced quizzes (Solomon & Rothblum, 1984), delay in handing in a term paper (Beswick et al., 1988), delay in submitting course requirements (Rothblum, Beswick, & Mann, 1984), and delay in participating in psychology experiments (Solomon & Rothblum, 1984). Furthermore, Ferrari (1989a) reported adequate internal consistency estimates for each part of the PASS and for both factors, ranging from .60 to .80, and acceptable test-retest reliabilities at one month ranging from .63 to .74. For the present study, the coefficient alpha reliability estimates of the PASS measures were .84 for the procrastination scale, .85 for the fear of failure factor, and .76 for the task aversiveness factor.

Data Analysis

The major analysis utilized in this study involved canonical correlation, which is a multivariate technique. A canonical correlation analysis was conducted to identify a combination of reason for procrastination dimensions (i.e., fear of failure and task aversiveness) which might be correlated with a combination of statistics anxiety dimensions (i.e., worth of statistics, interpretation anxiety, test and class anxiety, computational self-concept, fear of asking for help, and fear of the statistics instructor). Canonical correlation analysis is utilized to examine the relationship between two sets of variables when each set contains more than one variable (Cliff & Krus, 1976; Darlington, Weinberg, & Walberg, 1973; Thompson, 1980, 1984). Indeed, as noted by Knapp (1978, p. 410), "virtually all of the commonly encountered tests of significance can be treated as special cases of canonical correlation analysis." That is, canonical correlation analysis can be used to undertake all the parametric tests which canonical correlation methods subsume as special cases, including t-tests, multiple regression, analysis of variance, and analysis of covariance (Thompson, 1988).

In the present study, the six dimensions of statistics anxiety were treated as the dependent multivariate set of variables, whereas the two components of reason for procrastination were utilized as the independent multivariate profile. The number of canonical functions (i.e., factors) which can be generated for a given dataset is equal to the number of variables in the smaller of the two variable sets. Since the reason for procrastination section of the PASS has two dimensions and six dimensions of the STARS were used, two canonical functions were generated.

For the first canonical coefficient, standardized canonical function

coefficients and structure coefficients were computed. Standardized canonical function coefficients are computed weights that are applied to each variable in a given set in order to obtain the composite variate used in the canonical correlation analysis. As such, standardized canonical function coefficients are analogous to factor pattern coefficients in factor analysis or to beta coefficients in a regression analysis (Arnold, 1996). Structure coefficients are the correlations between a given variable and the scores on the canonical composite (i.e., latent variable) in the set to which the variable belongs (Thompson, 1980). Thus, structure coefficients indicate the extent to which each variable is related to the canonical composite for the variable set. Indeed, structure coefficients are essentially bivariate correlation coefficients which range in value between -1.0 and +1.0 inclusive (Thompson, 1980). The square of the structure coefficient is the proportion of variance that the original variable shares linearly with the canonical variate.

Results

The means and standard deviations pertaining to the PASS scale and the fear of failure and task aversiveness subscales are presented in Table 1. The PASS scale mean was compared to the mean reported by the developers of the PASS (Solomon & Rothblum, 1984). The norm groups used in Solomon and Rothblum's (1984) study comprised 342 university students (101 men, 222 women, 19 unknown gender) who were enrolled in two sections of an introductory-level psychology course. Ninety percent of the subjects were 18 to 21 years of age. Interestingly, the mean procrastination score reported by the graduate students in the present study (i.e., 34.52) was higher than that computed for subjects in Solomon and Rothblum's (1984) study (i.e., 33.39 for the full sample).

Unfortunately, these authors did not report the standard deviation of the PASS scores, thus an independent t-test for comparing the overall procrastination scores of the two samples could not be undertaken. In other words, it is not clear whether the mean procrastination score of the graduate students was statistically significantly higher than that of the undergraduate comparison group. Nevertheless, the graduate students in the current study had at least the same propensity to procrastinate as did the undergraduate norm group.

Insert Table 1 about here

Table 2 presents the means and standard deviations of the statistics anxiety measures. Also presented are median percentile rank equivalent scores (MPRES). The MPRES were calculated by comparing the median anxiety scores in the present study (Table 2) to the percentile rank norms reported by the developers of the STARS (i.e., Cruise et al., 1985). Thus, a MPRES of 86 for worth of statistics indicates that at least 50% of the present sample scored higher than did 86% of the norm group on this dimension. Since the MPRES range from 62 to 86, it is clear that the subjects in this study represented a moderate to high statistics-anxious group.

Insert Table 2 about here

An item analysis of the first part of the PASS was undertaken in order to determine the frequency of procrastination for a variety of academic tasks. This analysis revealed that 41.7% of the graduate students reported that they nearly

always or always procrastinate on writing a term paper, 39.3% procrastinate on studying for examinations, and 60.0% procrastinate on keeping up with weekly reading assignments. The corresponding percentages for the undergraduate students in Solomon and Rothblum's (1984) study was 46%, 27.6%, and 30.1%. As in Solomon and Rothblum's study, a smaller percentage of graduate students reported that they nearly always or always procrastinate on administrative tasks (17.3%), attendance tasks (6.8%), and school activities in general (16.5%). The corresponding percentages for Solomon and Rothblum's study were 10.6%, 23.0%, and 10.2%, respectively. A series of Fisher's Exact Tests was used to compare the prevalence rates between the present sample and the norm group. Findings revealed that, although compared to the norm group, a significantly ($p < .05$) smaller proportion of graduate students reported that they nearly always or always procrastinate on attendance tasks (odds ratio = 0.24), a significantly larger proportion of graduate students reported that they nearly always or always procrastinate on studying for examinations (odds ratio = 1.76), keeping up with weekly reading assignments (odds ratio = 3.46), administrative tasks (odds ratio = 1.72), and school activities in general (odds ratio = 1.69). In particular, the odds ratio pertaining to weekly reading assignments indicates that the graduate students in the present sample were nearly 3.5 times more likely to report that they nearly always or always procrastinate on keeping up with weekly reading assignments than were the undergraduate students in Solomon and Rothblum's study.

With respect to the degree to which the graduate students felt that procrastination was a problem for them, 23.7% reported that it was nearly always or always a problem when writing a term paper, 21.5% reported that this was a

problem when studying for examinations, and 41.5% indicated that it was a problem when undertaking weekly readings. The corresponding percentages reported by Solomon and Rothblum were 23.7%, 21.2%, and 23.7%, respectively. Nearly one-third of graduate students in the present study (i.e., 30.1%) indicated that procrastination was a problem for them when undertaking administrative tasks. Less than 20% of subjects reported that procrastination was a problem for them when they were involved in attendance tasks (18.8%) and school activities in general (8.3%). No statistics were reported by Solomon and Rothblum for these latter three types of activities, although these authors stated that "Procrastination was less of a problem with the remaining tasks and school activities in general" (p. 505). The Fisher's Exact Tests revealed that graduate students were 2.28 times more likely ($p < .05$) to report that procrastination was nearly always or always a problem when studying for examinations than were the norm group.

In terms of the extent to which subjects reportedly wanted to decrease their tendency to procrastinate, 65.2% indicated that they wanted or definitely wanted to reduce their procrastination when writing a term paper, 68.2% wanted to reduce it when studying for examinations, and 71.7% wanted to reduce it when undertaking reading assignments. The corresponding percentages reported by Solomon and Rothblum were 65.0%, 62.2%, and 55.1%, respectively. Nearly one-third of the graduate students (i.e., 30.1%) indicated that they wanted to decrease their tendency to procrastinate when undertaking administrative tasks, 24.1% when they were involved in attendance tasks, and 42.8% when undertaking school activities in general. Again, no statistics were reported by Solomon and Rothblum for these latter three types of activities, although these authors

stated that "For the remaining tasks, fewer subjects wanted to reduce their procrastinatory behavior" (p. 505). The Fisher's Exact Tests revealed that graduate students were 2.09 times more likely ($p < .05$) to report that they wanted or definitely wanted to reduce their procrastination when studying for examinations than were the norm group.

Table 3 presents the correlation matrix from which the canonical roots were generated. It can be seen that (1) the procrastination measure was positively correlated with interpretation anxiety, test and class anxiety, and fear of asking for help; (2) the fear of failure factor was positively related to all six statistics anxiety dimensions; and (3) the task aversiveness factor was positively associated with all six statistics anxiety dimensions.

Insert Table 3 about here

The strength of the relationship between the two sets of variables was assessed by examining the magnitude of the canonical correlation coefficients. These coefficients indicate the degree of relationship between the weighted procrastination dimension variables and the weighted statistics anxiety variables. In addition, the significance of the canonical roots was tested via the F-statistic based on Rao's approximation (Rao, 1952).

The canonical analysis revealed that both canonical correlations combined were statistically significant ($F [12, 254] = 3.84, p < .05$). However, when the first canonical root was excluded, the remaining canonical root was not statistically significant. Together, these results suggest that the first canonical function was statistically significant, but the second canonical root

was not statistically significant. However, since the calculated probabilities are sensitive to sample size, particular attention should be paid to the educational (practical) significance of the obtained results (Thompson, 1980). The educational significance of canonical correlations typically are assessed by examining their size (Thompson, 1980, 1984, 1988, 1990). The canonical correlation indicates how much variance the sets of weighted original variables share with each other (Thompson, 1988). In the present study, the first canonical correlation ($R_{c1} = .26$) appeared to be moderately educationally significant, contributing 6.8% (i.e., R_{c1}^2) to the shared variance. However, the second canonical correlation ($R_{c2} = .03$) did not appear to be educationally significant. Consequently, only the first canonical correlation was interpreted.

Data pertaining to the first canonical root are presented in Table 4. This table provides both standardized function coefficients and structure coefficients. An examination of the standardized canonical function coefficients revealed that, using a cutoff correlation of 0.3 recommended by Lambert and Durand (1975) as an acceptable minimum loading value, two of the six statistics anxiety dimensions (i.e., worth of statistics and fear of asking for help) made an important contribution to the anxiety composite--with fear of asking for help being the major contributor.

With respect to the reason for procrastination set, both dimensions (i.e., fear of failure and task aversiveness) made an important contribution to the composite set. However, although the absolute magnitude of the standardized function coefficients may be relatively reliable in ascertaining the contribution of a variable to the composite, the numerical values of these coefficients are highly affected by the collinearity of the variables in a given set (Thompson,

1990). Due to the moderate to large statistically significant intercorrelations (not presented) between the two reason for procrastination factors ($r = .36$, $p < .001$), and among the statistics dimensions (the intercorrelations ranged from .39 to .76), the structure coefficients represented the primary statistics that were interpreted.

The structure coefficients (Table 4) revealed that all six dimensions of statistics anxiety made important contributions to the first canonical variate. The square of the structure coefficient (Table 4) indicated that worth of statistics, fear of the statistics instructor, fear of asking for help, and computational self-concept made very large contributions, explaining 72.3%, 63.8%, 62.9%, and 54.0% of the variance, respectively. Interpretation anxiety and test and class anxiety made moderate contributions. With regard to the reasons for procrastination cluster, both dimensions made noteworthy contributions, with fear of failure making the largest contribution--explaining 76.4% of the variance.

Insert Table 4 about here

Discussion

The purpose of this study was (1) to examine the prevalence of procrastination among graduate students, and (2) to investigate the relationship between academic procrastination and six dimensions of statistics anxiety. Interestingly, this appears to be the first study to determine the prevalence of academic procrastination among graduate students. Findings revealed that from approximately 40% to 60% of the graduate students reported that they nearly

always or always procrastinate on writing a term paper, studying for examinations, and keeping up with weekly reading assignments. Additionally, between 20% and 45% of graduate students reported problems with procrastination in these three areas. Furthermore, between 65 and 75% of the students wanted to decrease their procrastination on these tasks. As noted by Solomon and Rothblum (1984), the high frequency of self-reported procrastination on writing term papers, studying for examinations, and keeping up with weekly reading assignments, suggests that these tasks are deemed to be more important to students than are such tasks as attending classes or meetings, filling out forms, and registering for courses.

An extremely disturbing finding is that a larger proportion of students in the present study than in the undergraduate norm group reported that they nearly always or always procrastinate on studying for examinations and on weekly reading assignments. These results are extremely surprising, bearing in mind that graduate students tend to represent the upper echelon of academic achievers. In fact, the mean grade point average of the present sample was 3.57, which confirms their high-achieving status. Unfortunately, Solomon and Rothblum (1984) did not report the mean grade point average of their undergraduate sample. However, it is extremely likely that the present sample had a significantly higher mean grade point average than did their undergraduate comparison group. Thus, an important area of future research is to determine why academic procrastination appears to be so high among graduate students. For example, it is possible that the high degree of procrastination reflects the complexity of course material and assignments at this level relative to the undergraduate level. That is, students who were low procrastinators in their undergraduate years, once they become

graduate students, are somewhat intimidated by the increased level of complexity and academic standards--whether perceived or real--and thus increase their levels of procrastination. Thus, an interesting line of research would be whether levels of academic procrastination are stable across students' undergraduate and graduate years.

It is also possible that graduate students' levels of academic procrastination are high for different reasons than are those of undergraduate students. Specifically, whereas undergraduate students' procrastination may be the result of low academic ability and low self-confidence (Rothblum et al., 1986; Ferrari, 1989b), rebelliousness and resentment (Burka & Yuen, 1983; Milgram, Sroloff, & Rosenbaum, 1988; Rorer, 1983), or an attempt to protect a vulnerable self-esteem (Burka & Yuen, 1983), it is possible that for graduate students, delaying academic tasks such as writing a term paper are indicative of perfectionism. Indeed, as noted by researchers (Ferrari, 1992; Onwuegbuzie, 1999c; Saddler & Sacks, 1993; Solomon & Rothblum, 1984), some procrastinators engage in perfectionism either in order to produce a flawless product (i.e., self-perfectionism) or to impress others by one's efforts (i.e., socially prescribed perfectionism). Indeed, Onwuegbuzie (1997), in a qualitative study of graduate students enrolled in research methodology courses, found that perfectionistic behavior is associated with procrastinating over undertaking research proposals. Interestingly, levels of both self-oriented perfectionism and socially prescribed perfectionism are high among graduate students (Onwuegbuzie & Daley, in press). Thus, knowledge of the interplay between procrastination, perfectionism, and achievement among graduate students would be helpful.

Nevertheless, the fact that most graduate students appear to have problems with procrastination on writing term papers and studying for examinations might explain why underachievement is prevalent in research methodology (Onwuegbuzie, 1997) and statistics (Onwuegbuzie et al., 1997) classes. Presumably, procrastinating does not necessarily lead to underachievement in the majority of graduate students' courses, particularly those which represent their areas of study. However, in research methodology and statistics classes, which are considered by a large proportion of students to be the most difficult in their programs of study (Onwuegbuzie, 1998a), it is likely that frequent procrastination leads to detrimental performance--even if their procrastination is the result of perfectionistic behavior. As such, future studies should investigate the potential debilitating role of procrastination in these courses.

Perhaps the most disturbing finding in the present study was the fact that the graduate students were nearly 3.5 times more likely to report that they nearly always or always procrastinate on keeping up with weekly reading assignments than were the undergraduate students in Solomon and Rothblum's study. Bearing in mind the complex and laconic nature of statistics and research methodology textbooks, it is likely that the frequency of procrastination on keeping up with weekly reading assignments is even higher in statistics and research methodology courses. The implications for procrastination as an area of concern for statistics and research methodology instructors is self-evident. This finding is particularly disturbing since high procrastinating college students are more likely to report the presence of physical symptoms (Rothblum et al., 1986) and depression (Saddler & Sacks, 1993).

The second major finding in the present study was that procrastination

resulting from both fear of failure and task aversiveness appears to be related significantly to worth of statistics, interpretation anxiety, test and class anxiety, computational self-concept, fear of asking for help, and fear of the statistics instructor. The finding that academic procrastination is related to statistics anxiety is consistent with the bulk of the literature which has documented a relationship between procrastination and generalized and specific kinds of anxiety such as fear of failure, test anxiety, social anxiety, and self-consciousness (Ferrari, 1991c; Milgram, 1991; Rothblum et al., 1986; Solomon & Rothblum, 1984).

Moreover, the finding that procrastination resulting from fear of failure is related to statistics anxiety is in accordance with Solomon and Rothblum (1984), who reported a statistically significant positive correlation between the fear of failure factor and evaluation anxiety. In contrast, the relationship between procrastination resulting from task aversiveness and statistics anxiety contradicts Solomon and Rothblum's (1984) finding of no relationship between the task aversiveness factor and evaluation anxiety. This incongruency, however, perhaps highlights the uniqueness of the statistics anxiety construct from other forms of anxiety. In any case, the relationship between academic procrastination and statistics anxiety provides further evidence that procrastination is more than a deficit in time management and study skills, but includes cognitive-affective components (Rothblum et al., 1986; Solomon & Rothblum, 1984). In fact, according to Rothblum et al. (1986), high procrastinators do not differ in their study behavior as much as they differ on anxiety.

Although there is strong evidence that there is a relationship between academic procrastination and statistics anxiety, it is not clear whether it

represents a causal relationship. Assuming this is the case, it is not within the scope of the present investigation to determine the causal direction. That is, it is not clear whether academic procrastination is the cause of statistics anxiety or whether statistics anxiety is the driving force for academic procrastination. It seems likely that a bidirectional relationship exists between academic procrastination and statistics anxiety, with each affecting the other. Were this true, it would indicate that academic procrastination and statistics anxiety are intricately intertwined. For example, it is possible that, once enrolled in statistics and research methodology courses, high procrastinators experience extreme elevations in statistics anxiety, since these classes threaten their self-esteem (Onwuegbuzie, 1999d), levels of hope (Onwuegbuzie, 1998b), and the like, which result from the perception that these courses are too difficult, as well as from an attitude that statistics is not relevant for them (Onwuegbuzie, 1999a). Individuals who experience increases in levels of statistics anxiety are more likely to postpone undertaking statistical activities and assignments (e.g., writing term papers, studying for examinations, and keeping up with the weekly readings) due to task aversiveness. Subsequent difficulties in understanding the course material may lead to them being anxious about asking for help from either their instructors or their peers, for fear of revealing their procrastinatory tendencies and other inadequacies. This increase in statistics anxiety associated with fear of asking for help and fear of the instructor may be accompanied by test and class anxiety and interpretation anxiety stemming from fear of failure-based procrastination. These aspects may lead to further procrastination about studying for examinations and writing term papers, which, in turn, intensifies levels of statistics anxiety. In any case,

this cycle of procrastination and statistics anxiety is likely to continue until levels of both are maximized. Whereas for some students, the procrastination component of the cycle is likely to stem from a fear of failure, for others, task aversiveness is the driving force. It is likely that keeping up with weekly assignments is the most important challenge for high procrastinators, since a failure to do so would mean that the student would come to class unprepared and thus would feel more overwhelmed when presented with statistical concepts for the first time by her/his instructor.

The fact that subjects were predominantly female is an important limitation of the study. Although the fact that no gender differences were found in the present study with respect to overall academic procrastination, fear of failure, task aversiveness, and all six dimensions of statistics anxiety, as well as the fact that the overwhelming majority of previous research has documented that males and females report similar levels of academic procrastination (e.g., Effert & Ferrari, 1989; Ferrari, 1989a, 1991a, 1991b), suggest that the findings of the present study may be similarly generalizable to both male and female graduate students. However, female students have been found to report higher levels of statistics anxiety than do males (Benson, 1989; Benson & Bandalos, 1989; Demaria-Mitton, 1987; Zeidner, 1991), as well as to report higher levels of other academic-related anxiety, such as general test anxiety (Everson, Millsap, & Rodriguez, 1991; Hembree, 1988; Zeidner & Safir, 1989) and mathematics anxiety (Dew, Galassi, & Galassi, 1983, 1984; Levitt & Hutton, 1983; Llabre & Suarez, 1985; Meece, 1981; Ramirez & Dockweiler, 1987; Tobias & Weissbrod, 1980). These reported gender differences, as well as Solomon and Rothblum's (1984) finding that female undergraduate students reported higher levels of procrastination

resulting from fear of failure than did their male counterparts, make it unclear how generalizable the findings of the present study are across gender. This necessitates replicating the present study using more males.

Another limitation of the current study stems from the fact that subjects were almost exclusively Caucasian-Americans. Although Clark and Hill (1994) concluded that patterns of self-reported procrastination found in Caucasian-American undergraduate students generalize to African-American students, Onwuegbuzie (1999b) found that African-American graduate students have higher levels of statistics anxiety associated with worth of statistics, interpretation anxiety, and test and class anxiety than do their Caucasian-American counterparts--with effect sizes ranging from .45 to .56 standard deviations. As such, it cannot be assumed that the present findings generalize to graduate students of other ethnicities. Thus, more research in this area is needed using African-American and other ethnic groups.

The fact that academic procrastination was assessed via a self-report instrument, rather than on actual behavior, is perhaps another limitation of the study, since it is possible that students may give socially desirable responses. However, according to Rothblum et al. (1986), "self-reported procrastination has been validated against delay in taking self-paced quizzes (Solomon & Rothblum, 1984), delay in submitting course assignments (Rothblum, Beswick, & Mann, 1984), delay in participation in psychology experiments (Solomon & Rothblum, 1984), and lower course grades (Rothblum et al., 1984)" (p. 388). Nonetheless, future studies in this area should consider using behavioral measures of academic procrastination in addition to self-report instruments.

Several practical implications can be derived from the results of the

present study. Since approximately two-thirds of graduate students report that they want to reduce their tendencies to procrastinate when writing a term paper, studying for examinations, and undertaking reading assignments, instructors should find ways to help them accomplish this. For example, statistics and research methodology instructors could break up their term projects into parts, and require that each part be submitted for formal or informal grading at regular intervals. With respect to reading assignments, students might be asked to undertake a written or oral summary of each assigned reading. In fact, students can even be required to develop advance- or post-organizers (e.g., concept maps) of all material read, since these techniques have been found to increase levels of performance (Onwuegbuzie, 1999e). In addition, whereas some high procrastinators may benefit from traditional interventions for procrastination such as time management and study skills counseling (Green, 1982; Richards, 1975; Ziestat, Rosenthal, & White, 1978), self-discipline and self-criticism (Mulry, Fleming, & Gottschalk, 1994), compliance-based and defiance-based paradoxical strategies (Dowd et al., 1988; Dowd & Swoboda, 1984; Rohrbaugh, Tennen, Press, & White, 1981), and the use of external contingencies (Green, 1982), as noted by Rothblum et al. (1986), others may benefit more from interventions which focus on anxiety management and reduction. The latter could be accomplished through a number of cognitive and behavioral techniques, such as mental and emotive imagery, relaxation therapy, systematic desensitization, cognitive and covert modeling, thought stopping, cognitive restructuring, meditation, biofeedback, and neurolinguistic programming (Gilliland & James, 1983). Such students also could be given information about how to direct attention away from self-centered worries when they are engaged in statistical activities. Whatever interventions

are implemented, it is essential that their efficacy be documented.

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Table 1

Means and Standard Deviations of Procrastination Measures

Measure	M	SD
Procrastination Scale	34.52	12.80
Fear of Failure	9.82	4.35
Task Aversiveness	8.39	1.65

Table 2

Means, Standard Deviations, Medians, and Median Percentile Rank Equivalents¹ of Statistics Anxiety Measures

Dimension	M	SD	Median	Median Percentile Rank Equivalent
Worth of statistics	42.53	14.03	42	86
Interpretation anxiety	31.76	8.39	32	78
Test and class anxiety	27.10	7.12	28	70
Computational self-concept	18.33	6.21	18	70
Fear of asking for help	8.21	3.59	8	66
Fear of the statistics instructor	12.21	4.07	12	62

¹ The median percentile rank equivalent scores were obtained by comparing median anxiety scores to the percentile rank norms pertaining to graduate students reported by Cruise et al. (1985).

Table 3

Pearson Product-Moment Correlations of Procrastination Measures and the Statistics Anxiety Dimensions

Statistics Anxiety Factor	Procrastination Measures		
	Procrastination Scale	Fear of Failure	Task Aversiveness
Worth of Statistics	.15	.34***	.38***
Interpretation anxiety	.23**	.26**	.25**
Test and class anxiety	.20*	.20*	.24**
Computational self-concept	.15	.30***	.32***
Fear of asking for help	.26**	.39***	.26**
Fear of the statistics instructor	.09	.31***	.37***

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 4

Canonical Solution for First Function

Variable	Standardized Coefficient	Structure Coefficient	Structure ²
<i>Statistics Anxiety Dimension:</i>			
Worth of Statistics	0.460*	.850*	.723
Interpretation Anxiety	-0.038	.604*	.365
Test and Class Anxiety	-0.233	.520*	.270
Computational Self-Concept	0.213	.735*	.540
Fear of Asking for help	0.553*	.793*	.629
Fear of the Statistics Instructor	0.199	.799*	.638
<i>Reason for Procrastination Dimension:</i>			
Fear of Failure	0.684*	.874*	.764
Task Aversiveness	0.522*	.770*	.593

* loadings with large effect sizes